METHODS AND APPARATUS FOR PROVIDING VIDEO SERVICES SUCH AS VIDEO-ON-DEMAND, NEWS AND ADVERTISING SERVICES

Field of the Invention

5   The present invention relates to methods and apparatus for distributing multimedia data, e.g., movies, news, videos, etc. in a customized manner, e.g., in response to local needs or requests of individual subscribers.

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Background

          Multimedia data, e.g., data corresponding to multiple presentation medias, e.g., audio and video
15   medias, is commonly used to provide a wide variety of services from television, news shows, movies, etc. Methods for distributing multimedia data vary from, e.g., television broadcasts, cable networks, and satellites.

20   A goal of many multimedia distribution systems has been to provide users content, e.g., moves or news broadcasts, specifically directed to the particular needs, wants or desires of individual users.   For example, national satellite and cable providers have been
25   striving to find ways of providing local news content to specific regions of the country while broadcasting from a single site, e.g., a single satellite. In addition, multimedia distributors have been striving for ways to

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providing video services on demand to large numbers of
customers in a cost effective manner.

5 Video services which include the provision of,
e.g., movies, news shows, and sitcoms, continue to
expand. Unfortunately, given the current forms of video
distribution, e.g., cable, satellite broadcasts, etc.,
the provision of video on demand and/or customized local
news services remains difficult and/or expensive to
10 provide.

A Video-On-Demand (VoD) system is one in which
a user of a video or multimedia broadcast network is able
to receive video service upon demand. In the case of
15 video on demand services, a user of a service is allowed
to select what he/she wishes to view and is then able,
ideally, to view the requested video at a time of the
user's choosing. Often, VoD services are provided to
users for a fee. In fact, VoD service in the form of
20 Pay-Per-View (PPV) is an extremely profitable business
for cable and satellite broadcasters.

VoD systems can be characterized as immediate
VoD systems (iVoD) or near VoD (nVoD) systems.   In iVoD
25 systems, a user of the system can select an item, e.g., a
movie, for immediate viewing or for viewing at any time
desired by the user. In nVoD systems, a user can select
an item, e.g., movie, for viewing at any one of a
plurality of different set times at which the item is

being offered for viewing.

In some known iVoD systems, a large centralized
server is used to provide Video-On-Demand service
5   including features like stop, play and rewind, all from a
main server. Such systems are complicated by the need to
be able to provide different video streams on demand to
each of the users coupled to the main server. Such
distribution requirements are often in contrast to the
10 distribution capabilities available in most modern cable
systems where the same video signals are frequently
supplied to all users on a given branch of the cable
network. Such implementations of iVoD systems also have
the disadvantage of requiring relatively powerful and
15 therefore expensive centralized servers capable of
responding to video requests and commands from multiple
users at the same time.

Unfortunately, due to the bandwidth limitations
20 of available communications systems which service
multiple subscribers and/or the cost of providing a
centralized server capable of providing different video
streams to multiple subscribers, it is often not
commercially feasible to provide instantaneous video on
25 demand services to multiple subscribers using the known
centralized video server systems.

Given the implementation difficulties
associated with the known centralized iVoD systems, at

the present time, Pay-Per-View (PPV) is implemented
mostly as a form of a near Video-On-Demand (nVoD)
service.

5   In various known nVoD systems, multiple
instances of PPV programming are presented in a time-
staggered manner. This is illustrated in Fig. 1. In the
Fig. 1 example, there are four time-staggered instances
of a program and each instance of the program is

10   identified by a number in parentheses, e.g. program(0).
Each instance of a program may be encrypted or scrambled
to prevent service users from viewing the movies without
authorization. In the illustrated system each instance
of the program exists in a separate channel. The

15   duration of the program is L time units and there is an
inter-program delay, D, that separates presentations of a
program on the same channel. The subscriber to a nVoD-
based PPV service normally requests programming during a
particular time period. The subscriber is then presented

20   with the requested program at the end of a delay period
between program presentations. Presentation of the
program to the subscriber may involve providing the
subscriber with, e.g., a decryption key or a descrambling
authorization code required to view the program. An

25   addressable cable converter or satellite receiver may be
used to control presentation and decryption/descrambling
of the selected program.

          Accordingly, users of known nVoD systems

normally must wait until the start time of the next instance of a selected program before they can begin viewing the program.

5   Staggering the presentation of multiple instances of a program in the described known manner makes it possible to provide a near VoD service in which the maximum wait time of a user is reduced proportional to the number of program instances. However, nVoD
10   systems are limited by the number of available channels and by the economics of offering many instances of a few programs. This has the effect of forcing a trade-off between the number of unique services offered and number of instances of offered programs. By offering fewer
15   instances of a program, longer wait times result thereby reducing the quality of the on-demand experience.

In addition to wait times, another problem with known nVoD systems, where programs are displayed as they
20   are received, is that they deny the user the ability to stop, fast forward or reverse the program being displayed.

In order to provide limited stop, fast forward and reverse capabilities buffers are now being built into
25   some set top cable decoder boxes. Such boxes buffer a segment of a program and then allow a viewer, within the limits of the buffered program segment, to fast forward, pause and reverse the displayed image. In such decoder

boxes the contents of the buffer are updated with the
program as it is received with the oldest portion of the
buffer dedicated to the program being overwritten by the
most recent program data. While the use of buffering
5   provides some fast forward, pause and reverse capability,
it does not address the problem of wait times associated
with known nVoD systems.

While wait times associated with nVoD systems
10   represent one area of video service where improvement
would be useful, there is also a need for improvements in
broadcast news in regard to the provision of local news
content. In the case of satellite and other news
broadcasts originating from one or a few transmission
15   sites which service a large area of the country, viewers
are often deprived of local news due to the national
broadcasters unwillingness to dedicate the bandwidth
required to transmit a large number of very similar news
programs each of which may actually include only a small
20   amount of local news which is distinct from the news
included in the other broadcasts.

In view of the above discussion, it becomes
apparent that there is a need for improved methods and
25   apparatus for providing, e.g., distributing and
presenting, multimedia data to individuals. It is
desirable that at least some methods and apparatus be
capable of providing iVoD services and/or improved nVoD
services with low wait times. From a backwards

compatibility standpoint, it is desirable that at least some of the new broadcast methods and apparatus be compatible with existing cable boxes and/or set top decoders, thereby allowing gradual system upgrades

5   without rendering existing devices unusable. It is also desirable that at least some methods and apparatus be capable of providing local news and other targeted content to users while still permitting a centralized, e.g., national satellite based, broadcasting system.

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SUMMARY OF THE INVENTION

The present invention is directed to methods and apparatus for distributing multi-media data, e.g.,

15   video and audio data, corresponding to television programs, movies, etc.

In accordance with one embodiment of the present invention, a communication system is based on a

20   distributed architecture where a centralized video server is responsible for providing certain functions and local presentation devices, e.g., set-top boxes, are responsible for performing many of the operations associated with specific user requests. Server functions

25   may include, e.g., repetitive distribution of pay-per-view programs on a time staggered basis, distribution of regional and non-regional news segments and programs, and/or distribution of program information. The distributed program information may include, e.g., the

time and channel used to transmit a particular program or program segment, information on the program segments which are to be combined to form a complete program such as a regional news program, and/or user authorization

5 information authorizing specific user devices to present various pay-per-view or other program offerings.

User requests which the local presentation devices, e.g., set-top boxes, are responsible for

10 servicing include fast-forward, reverse, stop, and play requests. More significantly however, in response to a request for a pay-per-view program or regional news program, the local user devices, e.g., set top boxes, of the present invention are responsible for generating the

15 program to be presented from locally cached program data, e.g., program segments, and program data which is transmitted to the local user device, e.g., subsequent to a user requesting presentation of a specific pay-per-view program or the beginning presentation time, e.g., start

20 time, of a regional news program. Thus, in accordance with the present invention, local presentation devices are used to generate programs by combining or "stitching together" broadcast program data with previously cached program data.

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To facilitate the generation of programs from cached and broadcast program segments, accurate program timing information, e.g., time stamps or time codes, are included in both the cached and transmitted program

segments. For example, in the case of digital Video-On-Demand systems, Real-Time Transport Protocol (RTP) may be utilized. RTP is described in a document published by the Network Working Group, as RFC 1889, titled: "RTP: A Transport Protocol for Real-Time Applications" (Jan. 1996) In accordance with RTP, RTP time-stamps are included in the program segments and it is these time stamps which may be used to convey the necessary timing information. Another method for conveying program timing information, which may be used with the present invention is Normal Play Time (BPT), as defined in ISO/IEC 13818-6 titled: "Extension for Digital Storage Media Command and Control" (Draft July 1996).

Thus, as will be discussed further below, the present invention utilizes the caching of program segments at a local site, e.g., at each user device, to facilitate the provision of various services. When providing VoD and improved nVoD services, initial portions of each unique pay-per-view program being offered is cached. When a user of the system requests a specific pay-per-view program the corresponding cached segment is played back and additional video data obtained from a broadcast version of the program is used to supplement the cached program data allowing presentation of the full program with little or no wait time before the program is presented to the user.

The initial program segment caching and

playback techniques of the present invention allow for
the provision of VoD services or improved nVoD services,
in communication systems which already support nVoD
services through use of multiple time staggered
5   broadcasts of pay-per-view programs. The VoD services or
improved nVoD services of the present invention can be
provided in such known systems without rendering existing
set-top boxes unusable thereby avoiding the need to
replace existing user set top boxes.

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As will be discussed below, the feature of the
present invention which supports caching of regional news
segments allows for regional news programs, with both
regional and non-regional program content, to be
15   presented to a user. Thus, users can view regional news
programs without the need to broadcast the non-regional
program content with each regional news program. Thus,
customers of a centralized broadcast system such as a
satellite TV system can receive local news broadcasts
20   without requiring the broadcaster to transmit complete
local news programs on numerous channels.

Additional features, embodiments and benefits
of the methods and apparatus of the present will be
25   discussed below in the detailed description which
follows.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a known process of transmitting multiple instances of the same program in a time staggered manner.

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Fig. 2 illustrates a communication system implemented in accordance with the present invention.

Fig. 3 illustrates a routine used for
10 controlling operation of the video server illustrated in Fig. 2 in accordance with the present invention.

Fig. 4 illustrates the communication system of Fig. 2, with the user device being shown in greater
15 detail.

Fig. 5 illustrates a control routine used for controlling operation of a user device in accordance with the present invention.

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Fig. 6 illustrates a VoD pay-per-view presentation routine used for controlling the display of pay-per-view programs in accordance with the present invention.

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Fig. 7 illustrates a regional news presentation routine used for controlling the display of regional news programs in accordance with the present invention.

Fig. 8 illustrates a plurality of regional news programs and a non-regional news program each of which includes a plurality of news segments in accordance with the present invention.

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Fig. 9 illustrates the broadcasting of a PPV program on two channels.

Fig. 10 illustrates various aspects of

10 stitching streamed program data and cached program data together in accordance with the present invention.

Fig. 11 illustrates the broadcasting of a PPV program on four channels.

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DETAILED DESCRIPTION

The present invention relates to methods and apparatus for distributing multimedia data, e.g., movies,

20 news, videos, etc. in a customized manner, e.g., in response to local needs or requests of individual subscribers. In accordance with various embodiments of the present invention, VoD, improved nVoD and/or regional news services are provided to users of the communication

25 system of the present invention. This is done through the use of cached program data and program data which is received subsequent to the start of the presentation of a program to a user.

Fig. 2 illustrates a communication system 200 implemented in accordance with an exemplary embodiment of the present invention. As illustrated, the communication system includes a multimedia server 202, e.g., video

5   program server, for transmitting multi-media data, e.g., video and audio data, to a plurality of local user devices 204, 206, 208. The multi-media data may be transmitted via a cable connection or other communications medium 210. The communications medium may

10   include, e.g., a satellite, and/or television broadcasting system.. Each user device is coupled to a corresponding presentation device 205, 207, 209. The presentation devices 205, 207, 209 may take the form of, e.g., a television set or computer monitor. Each user

15   device and corresponding presentation device is normally located on the premises 211, 213, 215, e.g., home, hotel room or office, of a different user.

The multimedia server 202 comprises a set of

20   multimedia data 212, program guide & program/news segment information 246, a clock 242, program access controller 240, input device 248, output/display device 250, transmitter/receiver circuit 252, control routines 243 and control logic, e.g., a CPU 244.

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The multimedia data 212 may be stored in RAM, or non-volatile storage such as a hard disk drive array or any one of a plurality of known storage devices. The multimedia data 212 comprises a plurality of N pay-per-

view (PPV) programs, 214, 224, a set 232 of regional news
segments and a set 230 of non-regional news segments. In
addition to the news segments and pay-per view programs,
the multimedia data 212 may include non-pay preview

5   movies, television shows, etc.

In accordance with the present invention, the
PPV programs 214, 224 and news segments include timing
information which can be used for segmenting video

10   segments and/or combining video segments in a consistent
manner. For purposes of illustration, PPV programs 1
through N are each illustrated as being comprised of an
initial program segment 216, 226 and a main program
segment 218, 228, respectively.

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The set 234 of regional news segments includes
a first through M^{th} regional news segments 234, 236 while
the set 230 of non-regional news segments includes first
though X^{th} non-regional news segments 231, 235. As will

20   be discussed below, non-regional news programs comprise
one or more non-regional news segments. In contrast to
non-regional news programs, regional news programs
normally comprise one or more regional news segments in
addition to some non-regional news segments. In fact,

25   the truly regional news content of a regional news
program frequently tends to be relatively small compared
to the non-regional content of the regional news program.
This fact makes it practical to cache multiple regional
news segments and then to combine them at presentation

time with broadcast non-regional news segments to
effectively construct regional news broadcasts on the fly
at presentation time. By caching regional news segments
in accordance with the present invention and combining

5   them at presentation time with non-regional news
segments, multiple regional news programs can be
supported using a fraction of the transmission bandwidth
that would be required to transmit to each user device
204, 206, 208 a complete version of each regional news

10   program in addition to one or more non-regional news
programs.

The program guide & program/news segment
information 246 includes information on the broadcast

15   times of the N PPV programs 214, 224. It also includes
information on the broadcast times of the regional news
segments 234, 236 as well as the non-regional news
segments 231, 235. Along with broadcast time
information, the information 246 may include information

20   on how to construct multiple regional and/or non-
regional news programs from the transmitted regional and non-
regional news segments. For example, for each supported
regional and non-regional news program, the information
246 may include a list of news segments which form the

25   program, segment order information, and news segment
presentation time information. Such information is used,
as will be discussed further below, by a user device of
the present invention to generate, at presentation time
from the various news segments, a particular news program

selected by the user for viewing.

Operation of the multimedia server 202 is
controlled by control logic 244 in accordance with
5   instructions included in a server control routine 243.
The clock 242 provides timing information to the control
logic 244. The server control routine 243, when executed
by the control logic 244, causes the server 202 to
transmit the data 214, 224 representing the PPV programs
10   and the data 232, 230 representing the regional and non-
regional news segments, at the times indicated by the
program guide & program/news segment information 246.
Each of the PPV programs 214, 224 is transmitted
repeatedly on one or more transmission channels allowing
15   for both nVoD services and VoD services in accordance
with the present invention. The transmission channels
may be separate physical channels, separate logical
channels on the same physical channel, or a combination
of these. As will be discussed below, in systems where
20   all user devices which are to support the presentation of
PPV programs include the ability cache initial program
segments, the initial PPV program segments 216, 226 may
be transmitted once with the main program segments 218,
228 being transmitted repeatedly on a time staggered
25   basis.

Transmitter/receiver circuit 252, operating
under control of the control logic 244, is responsible
for performing the actual operation of transmitting the

program data and news segments. The transmitter/receiver circuit 252 is also responsible for receiving program access requests from user devices. The control logic 244, operating in conjunction with the program access

5   controller 240, issues users requesting to view PPV programs the encryption/descrambling or other authorization information required for the requesting user to be presented with a PPV program. The program access controller 240 also keeps track of billing data.

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The input device, e.g., keyboard, 248 may be used for inputting sever control information, for updating the program guide information 246 or for otherwise supplying input to the server 202, e.g., for

15 system maintenance purpose. Output device 250 can be used for displaying multimedia status information as well as other system information.

Fig. 3 illustrates the steps included in an

20 exemplary server control routine 243. The control routine 243 begins in start step 302 with the routine being loaded and executed by control logic 244. From step 302, operation proceeds to a plurality of steps, e.g., steps 304, 306, 312, 318, and 320 which may be

25 performed in parallel.

In step 304, the server is controlled to periodically transmit program guide & program/news segment information 246. The transmission of this

information may be performed on a regular predictable schedule, e.g., every minute or every few minutes.

In step 306, the server 202 is controlled to periodically transmit, in a time staggered manner, multiple instances of PPV programs 1 through N. In step 318, the server 202 is controlled to periodically transmit non-regional news segments, e.g., one or more segments in the set of non-regional news segments 230. Similarly, in step 318, the server 202 is controlled to periodically transmit regional news segments, e.g., one or more segments in the set of regional news segments 234. The periodic transmission of the PPV programs, regional news segments and non-regional news segments is performed by the server 202 in accordance with the transmission time information included in the program guide & program/news segment information 246.

In addition to transmitting programs and program segments, the server 202 is responsible for authorizing user devices to present PPV programs to requesting users. In step 312 the server is operated to monitor for PPV program access requests from users. Operation proceeds from step 312 to step 314 wherein a determination is made as to whether a PPV program access request was detected. If a PPV access request is not detected operation proceeds once again to monitoring step 312. If in step 314 a determination is made that a PPV program access request was detected, operation proceeds

to step 316. In step 316, the detected access request is processed. Assuming that the request is from a user in good standing, in step 316, the user device from which the request originated is authorized to present the

5   requested PPV program to the requesting user. This may involve enabling program viewing by supplying a decryption key and/or descrambling information to the requesting user device. In step 316 user billing information maintained by the server may be updated to

10   reflect a charge for viewing the user requested PPV program. Operation proceeds from authorization step 316 to monitoring step 312.

     The various steps in the server control routine

15   are performed, once started, until stopped, e.g., by shutting down the server 202.

     Having described operation of the multimedia server 202 in detail, operation of a user device which

20   can receive multimedia data and other information from the server 202 will now be discussed at length.

     Fig. 4 illustrates an exemplary user device, e.g., device 204, implemented in accordance with the

25   present invention. The user device, e.g., set top cable box or satellite receiver, comprises a video server interface 402, a device controller 406, program cache 420, user interface 414, user input device 416, display 418, program guide & program news segment information 412

and service presentation processing circuit 428.

The video server interface 402 includes a
transmitter/receiver circuit 404 for sending, e.g., PPV
5   program access requests, to the multimedia server 202 and
for receiving program data, e.g., PPV program segments,
news segments, and program guide & program/news segment
information from the multimedia server 202. Via the
circuit 404, the user device 204 can also receive
10   decryption codes, descrambling information and/or other
information required to present a PPV program to a user.

The video server interface 402 is coupled to
the various components 406, 402, 420, 428 of the user
15   device 204 via video/data bus 403. Program guide &
program/news segment information received from the video
server is stored in memory segment 412 under control of
the device controller 406. The device controller 406 is
responsible for controlling the overall operation of the
20   user device 204 in accordance with program presentation
control logic 408 and program access control logic 410
included in the device controller 406.

The device controller 406 is coupled to a user
25   input device 416 and a display device 418 through user
interface 414. The user input device may be, e.g., a
keypad or a remote control through which a user can make
channel selections, news program selections and/or PPV
program selections. The display device 418 may be a LCD

or other type of display for displaying channel, time
and/or program information. Display 418 may be omitted
in embodiments where the display of the presentation
device 205 is used to present an on-screen menu of

5   programs, control options, and other information, e.g.,
program guide information, to a user of the device 204.
While presentation device 205 is illustrated as being a
separate component from user device 204, it may be
incorporated into the user device to provide, e.g., a

10   cable or satellite ready TV or multimedia device.

Device controller 406 operates under control of
program access control logic 410 and program presentation
control logic 408. Program access control logic 410 can

15   be used, in response to user settings, to block certain
channels or programs from being displayed.

Program presentation control logic 408 is used
to control the storage of program data and information

20   and the presentation of programs to the user. Program
presentation control logic 408 includes a user device
control (UDC) routine 500, a VoD PPV presentation (VoD
PPVP) routine 600 and a regional news presentation (RNP)
routine 700. Each of these control routines will be

25   discussed further with regard to Figs. 6, 7, and 8,
respectively.

The device controller 406 interacts with the
program cache 420 and service presentation processing

circuit 428 via control bus 405 and video/data bus 403.

The program cache 420 includes a cache
controller 426 which is responsible for identifying,
5   e.g., from program information 412 supplied to it from
the device controller 406, program segments e.g., initial
PPV program segments 422 and regional news segments 420
which are to be stored in the cache. It is also
responsible for storing the identified program segments
10   to be cached in cache memory 425 and for retrieving from
the cache memory program segments as needed for
presentation purposes under control of control logic 408.
In one embodiment, cache memory 425 is implemented as a
combination of hard disk storage and RAM chips.
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Under control of the device controller 406, the
cache controller 426 updates the contents of the program
cache, corresponding to a particular program being
presented to a user, with data obtained from the video
20   server 202. Previous contents of the program cache
corresponding to a PPV program which have already been
presented to the user may be overwritten as part of the
cache updating process. As will be discussed below,
updating of the cache contents corresponding to a
25   particular program and the reading out of the cache
contents corresponding to the program is performed in
various embodiments on a (first-in, first-out) FIFO
basis. This effectively "stitches" together received
program data with previously cached program data, thereby

producing, at the output of the cache, a continuous and complete set of program data. This allows for a complete PPV program to be presented to a user without having to store the complete PPV program at any one time.

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Video data retrieved from the program cache is supplied via the cache controller 426 to the service presentation processing circuit 428. The processing circuit 428, under control of the device controller 406,

10   decrypts/descrambles PPV programs being presented. It also serves as an interface between the program cache and the presentation device 205 used to display the program or programs being presented. In the case of news programs, the service presentation processing circuit 428

15   may be used to combine cached regional news segments with non-regional news segments received from the video server 202. In this manner, a complete regional news program may be presented to a user without the need to store data corresponding to non-regional program segments.

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Fig. 5 illustrates the steps of the user device control routine 500 which is used to control operation of a user device, e.g., device 204, in accordance with the present invention. As illustrated, the routine 500

25   begins in step 502 wherein it is executed by the device controller 406. From step 502, operation proceeds to steps 504, 506 and 512 which may be performed in parallel.

In steps 504 and 506, the program data received from the server 202 is monitored to detect data, e.g., program segments which should be cached. The monitoring may be performed as a function of received program guide

5 & program/news segment information which may identify to device controller 406 the times at which program segments to be cached will be transmitted.

In step 504, the device controller 406 monitors

10 to detect the receipt of uncached initial PPV program segments. In step 506, the device controller 406 monitors to detect the receipt of uncached regional news program segments. Operation proceeds from steps 504, 506 to step 508. In step 508 a determination is made as to

15 whether or not an uncached initial PPV program segment or an uncached regional news segment was detected in steps 504, 506. If either an uncached initial PPV program segment or an uncached regional news segment was detected operation proceeds to step 510, otherwise operation

20 proceeds from step 508 back to monitoring steps 504, 506.

In step 510, the cache controller 426 is controlled to store the detected uncached initial PPV program segment or uncached regional news segment in the

25 program cache 425. Operation proceeds from step 510 back to monitoring steps 504, 506.

In addition to monitoring for the receipt of uncached program segments, the device controller 406, in

step 512, monitors to detect input from the user selecting, e.g., requesting, a PPV program or regional news program for viewing. Operation proceeds from step 512 to step 514. In step 514 a determination is made as 5 to whether or not a PPV program has been selected.

If a PPV program has been selected, operation proceeds to step 515. In step 515, a determination is made as to whether or not an initial program segment 10 corresponding to the user selected PPV program exists in the program cache 420. If an initial program segment corresponding to the selected program is not present in the program cache 420 operation proceeds to step 517. Step 517 is a GOTO nVoD PPV presentation sub-routine step 15 wherein operation proceeds to a conventional nVoD presentation routine prior to operation returning to step 512. Since the nVoD PPV presentation sub-routine which is accessed in step 517 is implemented in a conventional manner, it will not be described further herein.

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However, if in step 515 it is determined that an initial program segment corresponding to the user selected PPV program is present in the program cache 420, operation proceeds to step 516. Step 516 is a GOTO VoD 25 PPV presentation sub-routine step which serves to initiate operation of the VoD PPV presentation sub-routine 600. Upon returning from the VoD PPV presentation sub-routine 600, operation proceeds from step 516 once again to monitoring step 512.

In step 514, if it was determined that a PPV program was not selected, operation proceeds to step 518 wherein a determination is made as to whether or not a

5   regional news program was selected for viewing. If it is determined that a regional news program was not selected for viewing, operation proceeds from step 520 to monitoring step 512.

10   If, however, in step 518 it is determined that a regional news program was selected for viewing, operation proceeds to step 520. Step 520 is a GOTO regional news program presentation sub-routine step which serves to initiate operation of the regional news program

15   presentation sub-routine 700. Upon returning from sub-routine 700, operation proceeds from step 520 once again to monitoring step 512.

The VoD PPV presentation routine 600 will now

20   be described with reference to Fig. 6. The routine 600 begins in step 602 and proceeds to step 604. In step 604, the user sends a request to the multimedia server 202 requesting authorization from the server 202 to display the PPV program selected by the user. Following

25   the authorization request made in step 604, operation proceeds to step 606 in which the user device receives a decryption key and/or descrambling information which can be used to decrypt/descramble the requested program. Then, in step 608, the program guide and program

information 312 is used to identify for presentation purposes, one of the copies of the selected PPV program, which is periodically transmitted by the server 202.

5   From step 608 operation proceeds to step 610 in which the cached initial program segments corresponding to the selected PPV program is identified. Then in step 612, the user is presented with the selected PPV program by outputting to the user's presentation device, e.g.,

10   device 205, cached program data corresponding to the selected PPV program. As part of the process of presenting the cached program data to the user, the PPV program may be decrypted/descrambled by the service presentation processing circuit 428 using the

15   decryption/descrambling information obtained from the server 202.

While the cached PPV program data is being displayed, in step 614, the cache contents corresponding

20   to the PPV program being presented to the user are updated with data obtained from the transmitted copy of the program identified in step 608. The updating of the cached program contents continues until the program data corresponding to the end of the selected program is

25   cached. The PPV presentation routine 600 stops in step 616 when the end of the selected PPV is presented to the user. With the end of the program presentation, operation returns via step 616 to the user device control routine where operation continues at step 512.

The selection of a transmitted copy of a selected PPV program, which occurs in step 608, for purposes of combining the transmitted program data with the cached program data, will now be discussed in detail.

The diagram in Fig. 9 shows a schedule for the time staggered transmission of instances of a PPV program on a first channel (0) and a second channel (1). The PPV program is L time units long and there is an inter program delay of D time units in each program channel. The first instance of the PPV program is scheduled to begin in channel (O) at time $T_0 0$. The second instance of the PPV program is scheduled to begin in channel (1) at time $T_1 0$. The third instance of the PPV program is scheduled to begin in channel (O) at time $T_0 1$. The fourth instance of the PPV program is scheduled to begin in channel (1) at time $T_1 1$.

Given that the broadcasts of the PPV program are staggered in the two channels to provide uniform spacing between program presentations in the Fig. 9 embodiment, it can be seen that, in the given example:

$$T_1 0 = T_0 0 + L/2 \tag{1}$$

$$T_0 1 = T_0 0 + L + D \tag{2}$$

$$T_1 1 = T_1 0 + L + D \tag{3}$$

The actual times for the scheduled start of a

program may vary and can be obtained in accordance with the present invention from the transmitted program guide information 412. Thus it is to be understood that equations (1), (2) and (3) are merely exemplary program

5 start time guides provided for purposes of explanations.

The minimum length C of the initial program portion that is cached in the Fig. 9 embodiment to provide VoD service for the transmitted program is

10 determined as follows:

$$C = L/2 + D_{max} \hspace{3cm} (4)$$

Where D_{max} is the maximum delay between

15 presentations of the PPV program in a channel used to broadcast the program. Where program presentations are uniformly spaced, the delay D between each program transmission will be the same and D will equal D_{max}.

20 Assuming that a request for service occurs at time R, in step 610 of the PPV presentation routine 600, it is necessary to determine which of the two channels to use as a source of program material. The rule that the program access control logic uses in the case of the Fig.

25 9 example is:

Select channel K if $T_KY > R - C$ and $T_KY < R$ \hspace{1cm} (5)

Where T_KY indicates the Yth scheduled

occurrence of the selected program on the kth channel, in this example T_00, T_01, T_10 and T_11. In the Fig. 9 example, K may assume the values (0) or (1) since these are the only channels used.

5

Rule (5), which basically instructs the program access control logic to select the streamed PPV program in which the complete uncached portion of a program will first be available, ensures that the timing of the

10   selected streamed, e.g., broadcast, PPV program is such that the program presentation control logic 408 will have the opportunity to seamlessly stitch together, e.g., concatenate, the cached portion of the program with the streamed uncached portion of the program through control

15   of the cache controller 428.

In the example shown in Fig. 9, the request to view the PPV program occurs at time R. In step 608 the program presentation control logic will compute (R-C)

20   and, after consulting the program guide 412 will determine that program(1) 902 should be used to supplement the cached initial portion of the requested PPV program.

25   A particularly useful method of combining the cached initial program segment and data obtained from the streamed program is to append the streamed program data to the end of the cached initial program segment data. This may be done by storing the streamed program data

selected for use in the cache following the initial
program segment data and reading out of the cache in a
first-in, first-out manner.

5   In such an embodiment, the program access
control will track the current play time of the selected
streamed program, and will discard the program data while
the play time is below C time units. Thus, the broadcast
data corresponding to the cached initial program segment
10   is ignored or discarded.   This method of stitching
streamed program data with cached initial program data is
illustrated in Fig. 10.

         Fig. 10 illustrates a streamed program(n) 1000.
15   The broadcast program(n) 1000 starts at time T_nK and
stops L time periods later. For purposes of explaining
the stitching of broadcast program data with cached
initial program segment data it is assumed that the
program presentation control logic 408 has selected the
20   data from program(n) 1000 to be used to supplement the
cached initial program segment. The time at which the
user initiates a request to view the PPV program of which
program(n) is a copy, occurs at time R.   Time R occurs Z
time periods after the start of program(n). Accordingly,
25   the portion of program(n) prior to time R will have been
ignored.   Thus, in Fig. 10, the program segment labeled
ISPS corresponds to an ignored streamed program segment.

         After accessing program(n) in response to the

viewing request initiated at time R, the program
presentation control logic 408 will extract timing
information that is present in program(n) 1000 and will
discard the streamed program data that corresponds to the

5   time period after time R and before time (TnK + C). Time
(TnK + C) corresponds to the stitch point SP shown in
Fig. 10. Thus, the data corresponding to the portion of
program(n) labeled DSPS will be discarded.

10   At time (TnK + C) program presentation control
logic 408 begins to stitch the streamed program data that
exists after time (TnK + C) to the end of the cached
initial program segment, e.g., by storing the data in the
same FIFO data structure in which the initial program

15   segment is stored in the cache 425. In this manner, a
seamless presentation can be provided to the user by
simply reading data out of the cache and processing it,
e.g., descrambling or decrypting it, for presentation
purposes. Thus, the data corresponding to the portion of

20   program(n) labeled USPS (utilized streamed program
segment) will be stitched to the cached initial program
segment to provide data corresponding to a complete
presentation of program(n).

25   It should be noted that as an alternative, to
the stitching illustrated in Fig. 10, stitching of the
cached initial program segment material and streamed
program material may be implemented as soon as the timing
information of the streamed program has been determined.

However, this approach may be less desirable than
starting the stitching at the end of the cached programs
segment since this method involves storing over the same
program material that was already stored, e.g., cached.

5

The minimum size of the stored initial portion
of programming material required to implement a VoD
system, as opposed to a nVoD system, depends upon the
number of program instances, n, the length of a program
10   and a maximum inter-program delay D_{max}. Equation (2) was
specific for the case where there are two recurring
instances of a program being transmitted (n=2), and in
general the following rule may be used to determine the
lower bound of C:

15

$$C = L/n + D_{max}/(n-1) \qquad (6)$$

where C, L, and D_{max} are as described above and
where n (N>1) is the number of parallel offerings or
20   instances of a program. Normally, n will equal the
number of channels used to offer the same PPV program.

Fig. 11 shows an exemplary program scheduling
for n = 4. In this case the lower bound, e.g., shortest
25   period of C which will support a VoD system, is computed
as follows

$$C = L/4 + D_{max}/3 \qquad (7)$$

Assuming that the PPV program is segmented into an initial segment and a main program segment, C will equal the maximum delay period which may occur between broadcasts of the main program segment.

5

In Fig. 11, a user request to view the program occurs a time R. In response to the user request the program presentation control logic 408 will access the scheduling information 412 and determine that the presentation in channel (1) should be selected as the

10 streamed program to be used for stitching purposes. Thus, program (1) 1102 will be selected. With program(1) 1102 having been selected, the program presentation control logic 408 will then access received program(1)

15 data and then examine the timing information included therein to determine when to begin the stitching process.

The use of multiple instances of a program in an nVoD system allows the amount of the initial portion

20 of a program that must be stored to be kept low. This has the benefit of allowing the initial portions of multiple unique programs to be stored using a practical amount of hard disk storage and for the instantaneous Video-On-Demand service to be supported for each of the programs

25 for which an initial program segment is cached. The reduction in the size of the initial program segment which must be cached occurs at the expense of requiring multiple channel resources. However, the costs incurred in providing instantaneous Video-On-Demand service when

utilizing the method described in this invention can be much lower than a system in which each individual user is assigned a separate channel resource.

5   The caching and program stitching methods of the present invention have been described up to this point for use in providing VoD service. However, the initial program segment caching and stitching method of the present invention can also be used to provide

10   improved nVoD service. By caching initial program segments which are of shorter duration than that required for true VoD service, and then by performing program stitching at playback time in the above described manner, an enhanced nVoD service is achieved. The enhanced nVoD

15   service of the present invention will have average wait times which are reduced, e.g., lower than, the average wait times which would result if caching and program stitching were not used.

20   Having described the PPV provisioning features of the present invention in detail, the regional news provisioning features will be described further with reference to Fig. 7. Fig. 7 is a flow chart illustrating the steps of the regional news presentation

25   routine 700.

The regional news presentation routine 700 begins in start step 702 and proceeds to step 704. In step 704, the program guide and program information 312

are accessed to identify non-regional news segments and regional news segments which comprise the user selected regional news program. As discussed above, regional news programs often comprise a large portion of non-regional

5   news. With the segments which comprise the selected regional news program identified, operation proceeds to step 708 wherein program cache is accessed to obtain data corresponding to regional news segments identified in step 704. Then in step 710, the requested regional news

10 program is presented to the user of the system by presenting the identified regional news segments in the order and at the times indicated by the program guide and program information 312. This is done by outputting the cached regional news data and the streamed, e.g.,

15 broadcast non-regional news data, at the appropriate times.

Once the regional news program presentation is completed, operation return to the user device control

20 routine via return step 712.

The new program feature of the present invention can be readily understood in view of the examples shown in Fig. 8.

25

In Fig. 8, row 805 represents the contents of a first communications channel and row 801 represents the contents of a second communications channel. Each channel may correspond to a different broadcast

frequency. In the exemplary embodiment, channel 805 is
not directly accessible by the viewer in the form of an
available channel selection.

5   The label NST is used to indicate news program
start time while the label NET is used to indicate news
program end time. For exemplary purposes is assumed that
the regional and non-regional news programs have the same
start and stop times, e.g., they may all be 30 minute
10   news programs which start at 10 PM and end at 10:30 PM.
In such a case NST = 10 PM and NET = 10:30 PM.

          The regional news program segments 803
including regional news segments (RNS) RNS1 243 through
15   RNS8 838 are transmitted prior to the start time NST of
the non-regional, e.g., national news program 840 which
is comprised of non-regional news segments (NRNS) NRS1
231 through NRNS5 835. While in fig. 8 the regional and
non-regional news segments are shown as being transmitted
20   in separate channels, in various embodiments the non-
regional and regional news segments are transmitted in
the same channel.

25   In accordance with the present invention, the
regional news segments will be cached in the program
cache 420 prior to the news start time. Accordingly,
they will be available for presentation at any point
during the news presentation period extending from NST to

NET.

Since the non-regional, e.g., national, news
program 840 is broadcast in complete form, starting at
5   the presentation time, the non-regional program segments
need not be cached. However, if segments of the non-
regional news program are to be incorporated into a
regional news program for presentation at a time which
differs from the segment's presentation in the non-
10   regional news program, the segments may be cached for
time shifting purposes.

As discussed above, in accordance with the
present invention, regional news programs are constructed
15   at presentation time from cached regional news segments
and non-regional news segments.

The lower portion of Fig. 8 illustrates how two
regional news programs 802, 820 and the non-regional news
20   program 840 may be constructed from the data transmitted
in channel 801 and presented to a user between times NST
and NET.

The New York regional news program 802
25   comprises regional news segment 1 234, non-regional news
segment 2 804, regional news segment 5 806 and regional
news segment 6 808. The regional news program 802 is
presented to the user by retrieving and presenting cached
regional news segment 1 234, by presenting non-regional

news segment 2 804 at the time it is received, followed
by presenting regional news segment 5 and 6 806, 808
which are retrieved from the program cache 420 for
presentation purposes. Program presentation control

5   logic 408 which controls the cache controller 426 and
service presentation processing circuit 428 controls the
service presentation processing circuit 428 to switch
between outputting the cached and streamed program data
at the appropriate times.

10

        The second regional news program, the Idaho
regional news program 820, is generated in a similar
manner from cached regional news segment 2 824, streamed
non-regional news segment 2 804, and cached non-regional

15   news segments 3 (834), 7 (836) and 8 (838).

        Non-regional news program 840 is generated by
simply presenting non-regional news segments 1 through 5
(231, 804, 837, 839) as they are received.

20

        Exemplary contents of regional news segments 1
and 2 would be customized introductory segments which
include information identifying the particular news
program being presented. Non-regional news segment 2 may

25   include a story on, e.g., the presidential election or
other story of national interest. Regional news segments
3 and 5 may include local weather information. Regional
news segments 6 and 7 and 8 may include, e.g., local
sports news and/or stories of local interest.

Given that the non-regional news forms a significant portion of regional news programs 802, 820 the technique of the present invention of combining streamed non-regional news segments with cached regional news segments offers an opportunity to provide numerous regional news programs to a user without having to dedicate the bandwidth that would normally be required to transmit complete copies of the regional news programs.

While the same start and stop times are shown for the regional and non-regional news programs, the regional news presentation technique can be used whenever non-regional news broadcasts have a portion of their broadcast time overlapping the presentation time of a regional news program or sufficient buffer space exists to buffer the non-regional news segments included in a requested regional news program.

In accordance with the present invention , the multimedia server 202 is normally located remotely from the customer premises where the user device or devices 204, 206, 208 are located. For example, in one embodiment, user devices 204, 206, 208 are located in individual homes separated by several miles of distance while the server 202 is located at a remote satellite broadcasting device hundreds of miles away.

Variations on the above described exemplary embodiments will be apparent to those skilled in the art in view of the above description of the invention. Such embodiments are considered to be part of the present
5   invention.

For example, local advertisements can be broadcast, cached and then combined with other program segments to form programs with local advertising content
10   in a manner which is the same as, or similar to, the manner in which regional news programs including non-regional news segments are generated. Accordingly, one embodiment of the present invention is directed to the broadcasting of local or regional advertising segments,
15   caching at user devices of the local or regional advertising segments, and the presentation of the local or regional advertising segments along with non-regional program segments, e.g., television program segments. In such an embodiment, the television program presented to
20   the user may be considered a regional program comprising non-regional program segments, e.g., the television program segments, and regional program segments, e.g., the regional advertising segments.

25   Other examples of regional and non-regional program segments include, e.g., local weather forecasts and national weather information, respectively. In accordance with the present invention, the regional and/or non-regional program segments may be cached and

combined to form a complete program, e.g., at
presentation time.

While the term time units has been used in the
5   present application, it is to be understood that the
particular unit of time is not critical so long as the
same units are used to measure the various times
discussed herein. For example a time unit may be, e.g.,
a minute, second or fraction thereof. In addition, while
10   the maximum delay between the presentation of certain
programs or program segments is discussed above, it is to
be understood that the utilized maximum delay period
corresponds to the delay which may occur in a limited
preselected period of time, e.g., the maximum delay which
15   will occur during a given day. The maximum delay for a
particular program may change on different days or weeks
depending on changes in program offerings during the
different days or weeks.